

II. SPECIFICATION

Please delete the Section beginning on page 4, line 1 entitled "SUMMARY OF THE INVENTION" and replace it as rewritten below

- SUMMARY

The disclosed embodiments present a method and a system with which an acoustic virtual environment can be transmitted to the user with a reasonable calculation load. In one aspect, the method and a system are able to take into account how the pitch and the arrival direction of the sound affect the direction of the sound.

In one aspect, the disclosed embodiments model the sound source or its early reflection by a parametrized system function where it is possible to set a desired direction of the sound with the aid of different parameters and to take into account how the direction depends on the frequency and on the direction angle.

In one aspect, a method for processing directed sound in an acoustic virtual environment in an electronic device, said acoustic virtual environment comprising at least one sound source, comprises defining a reference direction and a set of selected directions for the at least one sound source, each selected direction differing from said reference direction establishing a direction dependent filtering arrangement having at least one parameter disposed to at least partly determine a filtering effect of the direction dependent filtering arrangement, said at least one parameter enabling the direction dependent filtering arrangement to model how sound emitted by said at least one sound source sounds when listened from a

direction that deviates from said reference direction, for each selected direction defining a value (values) of said at least one parameter, and

- filtering a signal representing the sound emitted by said at least one sound source with the direction dependent filtering arrangement.

In one aspect, a system for processing directed sound in an acoustic virtual environment comprising at least one sound source comprises:

- means for defining a reference direction and a set of selected directions for the at least one sound source, each selected direction differing from said reference direction,

- a direction dependent filtering arrangement disposed to filter a signal representing sound emitted by said at least one sound source, the direction dependent filtering arrangement having at least one parameter disposed to at least partly determine a filtering effect of the direction dependent filtering arrangement, said at least one parameter enabling the direction dependent filtering arrangement to model how the sound emitted by said at least one sound source sounds when listened from a direction that deviates from said reference direction, and

- means for associating each selected direction with a value (values) of said at least one parameter.

The model of the sound source or the reflection calculated from it comprises direction dependent digital filters. A certain reference direction, called the zero azimuth, is selected for the

sound. This direction can be directed in any direction in the acoustic virtual environment. In addition to it a number of other directions are selected, in which it is desired to model how the sound is directed. Also these directions can be selected arbitrarily. Each selected other direction is modeled by digital filter having a transfer function which can be selected either to be frequency dependent or frequency independent. In a case when the examination point is located somewhere else than exactly in a direction represented by a filter it is possible to form different interpolations between the filter transfer functions.

When we want to model sound and how it is directed in a system where the information must be transmitted in a digital form it is necessary to transmit only the data about each transfer function. The receiving device, knowing the desired examination point, determines the sound is directed from the location of the sound source towards the examination point with the aid of the transfer functions it has reconstructed. If the location of the examination point changes in relation to the zero azimuth the receiving device checks how the sound is directed towards the new examination point. There can be several sound sources, whereby the receiving device calculates how the sound is directed from each sound source to the examination point and correspondingly it modifies the sound it reproduces. Then the listener obtains an impression of a correctly positioned listening place, for instance in relation to a virtual orchestra where the instruments are located in different places and where they are directed in different ways.

The simplest alternative to realize direction dependent digital filtering is to attach a certain amplification factor to each selected direction. However, then the pitch of the sound will not

be taken into account. In a more advanced alternative the examined frequency band is divided into sub-bands, and for each sub-band there are presented their own amplification factors in the selected directions. In a further advanced version each examined direction is modeled by a general transfer function, for which certain coefficients are indicated which enable the reconstruction of the same transfer functions. - -